420 Rec'd PCT/PTO 14 JAN 2000

FORM PTO-1390
(REV. 5-93)

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER
10191/1227

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
09/462863

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED:
PCT/DE98/01938	**11 July 1998 (11.07.98)**	**15 July 1997 (15.07.97)**

TITLE OF INVENTION
METHOD FOR GENERATING AN IMPROVED IMAGE SIGNAL WHEN ESTIMATING THE MOTION OF IMAGE SEQUENCES, IN PARTICULAR A PREDICTION SIGNAL FOR VIDEO IMAGES USING MOTION-COMPENSATING PREDICTION

APPLICANT(S) FOR DO/EO/US
BENZLER, Ulrich and WERNER, Oliver

Applicant(s) herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) immediately rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   - b. ☒ has been transmitted by the International Bureau.
   - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   - b. ☐ have been transmitted by the International Bureau.
   - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (unsigned)
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
    ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: International Search Report, Preliminary Examination Report and PCT/RO/101.

Express Mail No.: EM360463953US

420 Rec'd PCT/PTO 14 JAN 2000

U.S. APPLICATION NO if known, see 37 C F R 1 5	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
09/462863	PCT/DE98/01938	10191/1227

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Search Report has been prepared by the EPO or JPO $840.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) . $670.00		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) $760.00		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO $970.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) $96.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 840	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

Claims	Number Filed	Number Extra	Rate		
Total Claims	7 - 20 =	0	X $18.00	$0	
Independent Claims	1 - 3 =	0	X $78.00	$0	
Multiple dependent claim(s) (if applicable)			+ $260.00	$	
TOTAL OF ABOVE CALCULATIONS =				$840	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				$	
SUBTOTAL =				$840	
Processing fee of $130.00 for furnishing the English translation later the ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$840	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property +				$	
TOTAL FEES ENCLOSED =				$840	
				Amount to be: refunded	$
				charged	$

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 11-0600 in the amount of $840.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 11-0600 . A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

By: Reg No 35,952

SIGNATURE

SEND ALL CORRESPONDENCE TO:
Kenyon & Kenyon
One Broadway
New York, New York 10004

Richard L. Mayer, Reg. No. 22,490
NAME

1/14/00
DATE

[10191/1227]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s)	:	Ulrich BENZLER and Oliver WERNER
Serial No.	:	To Be Assigned
Filed	:	Herewith
For	:	METHOD FOR GENERATING AN IMPROVED IMAGE SIGNAL WHEN ESTIMATING THE MOTION OF IMAGE SEQUENCES, IN PARTICULAR A PREDICTION SIGNAL FOR VIDEO IMAGES USING MOTION-COMPENSATING PREDICTION
Examiner	:	To Be Assigned
Group Art Unit	:	To Be Assigned

Assistant Commissioner for Patents
Washington, DC 20231

PRELIMINARY AMENDMENT

Sir:

Kindly amend the above-identified application before examination as follows:

IN THE SPECIFICATION:

On page 1, delete lines 1 and 2, and insert:

- -Field Of The Invention- -.

On page 1, before line 12, insert:

- -Background Information- -.

On page 1, line 12, change "EP 0 558 922 B2" to - -No. 0 558 922- -.

On page 1, line 21, delete "the".

On page 2, delete lines 23 and 24, and insert:

- -Summary Of The Invention- -.

On page 2, line 25, change "measures" to - -principles- -.

On page 3, line 7, change "EP 0 558 922 B1" to - -No. 0 558 922- -, and before "design" insert - -to- -.

On page 3, line 12, change "measures" to - -principles- -.

On page 3, delete lines 18-31 and insert:

- -Brief Description Of The Drawings

Figure 1 shows a positional diagram.

Figure 2 shows an interpolation diagram for pixels between the pixel scanning raster.

Figure 3 shows the structure of an FIR filter for interpolation.

Figure 4 shows a further interpolation having an even higher resolution.

Detailed Description- -.

On page 4, lines 14 and 15, change "EP 0 368 151 B1" to - -No. 0 368 151- -.

On page 8, line 1, change "Patent Claims" to - -What Is Claimed Is- -.

IN THE CLAIMS:

Please cancel original claims 1-5, and please cancel substitute claim 1, without prejudice.

Please add the following new claims:

6. (New) A method for generating an image signal when estimating a motion of image sequences, motion vectors indicating, for each picture block of a current image, a position of the picture block used for a prediction with respect to a chronologically preceding reference image, the motion vectors being formed for each picture block, the method comprising the steps of:

in a first search step, determining a first motion vector with a pel accuracy;

starting out from the first motion vector, in a second search step, determining a second motion vector with a sub-pel accuracy by an aliasing-reducing interpolation filtering, using a digital filter, a resolution being selected to be higher than that corresponding to a resolution of a pixel raster in the first search step, more than four neighboring pixels being utilized for an interpolation of each pixel, to interpolate pixels between a scanning raster for the first search step; and

in a third search step, starting from the second motion vector, determining a third motion vector by a further interpolation filtering using the digital filter, a resolution being increased once more in comparison with the second search step, an interpolation being carried out on the basis of a pixel raster, with a resolution in the second search step.

7. (New) The method according to claim 6, wherein the image signal is a prediction signal for video images generated using a motion-compensating prediction.

8. (New) The method according to claim 6, wherein the more than four neighboring pixels are more neighboring pixels than are utilized for a bilinear interpolation.

9. (New) The method according to claim 6, wherein, for the interpolation filtering

in the second search step, an FIR filter is used having filter coefficients CO1 = 161/256, CO2 = -43/256, CO3 = 23/256, CO4 = -8/256.

10. (New) The method according to claim 6, wherein for the further interpolation filtering in the third search step, an FIR filter is used having FIR filter coefficients CO1' = 1/2, CO2' = O, CO3' = O, CO4' = O.

11. (New) The method according to claim 6, further comprising the steps of:

in order to predict video objects, separately conditioning, for each video object, filter coefficients of the digital filter; and

inserting the filter coefficients into a transmission bit stream at a beginning of transmission of an object in question.

12. (New) The method according to claim 6, further comprising the step of:

adapting, for an encoding of a motion vector for a transmission, a range of values of motion vector differences to be coded to an increased resolution.

IN THE ABSTRACT:

On page 10, line 1, change "Abstract" to

-- Abstract Of The Disclosure--.

On page 10, lines 9-11, change "interpolation methods. One" to - -interpolation methods. One- -.

REMARKS

This Preliminary Amendment cancels, without prejudice, original claims 1-5 and substitute claim 1 in the underlying PCT Application No. PCT/DE98/01938, and adds new claims 6-12. The new claims conform the claims to U.S. Patent and Trademark Office rules and do not add new matter to the application.

The amendments to the specification and abstract are to conform the specification and abstract to U.S. Patent and Trademark Office rules, and do not introduce new matter into the application.

The underlying PCT Application No. PCT/DE98/01938 includes an International Search Report, dated December 16, 1998, a copy of which is included. The Search Report includes a list of documents that were considered by the Examiner in the underlying PCT application.

The underlying PCT Application No. PCT/DE98/01938 also includes an International Preliminary Examination Report, dated June 17, 1999, a copy of which is included, including a translation.

Applicants assert that the present invention is new, non-obvious, and useful. Prompt consideration and allowance of the claims are respectfully requested.

Respectfully Submitted,

KENYON & KENYON

Dated: 1/14/00

By: [signature] Reg. No. 35,982

Richard L. Mayer
Reg. No. 22,490

One Broadway
New York, NY 10004
(212) 425-7200

242218

METHOD FOR GENERATING AN IMPROVED IMAGE SIGNAL WHEN ESTIMATING THE MOTION OF IMAGE SEQUENCES, IN PARTICULAR A PREDICTION SIGNAL FOR VIDEO IMAGES USING MOTION-COMPENSATING PREDICTION

Background Information

The present invention relates to a method for generating an improved image signal when estimating the motion of image sequences, in particular a prediction signal for video images using motion-compensating prediction, with motion vectors, which, for each picture block of a current image, indicate the position of the picture block used for the prediction with respect to a chronologically preceding reference image, being formed for picture blocks.

European Patent EP 0 558 922 B2 describes a method for improving motion estimation in image sequences, in half-pel accuracy, according to the full-search method. There, in a first process step, the search area, and in a second process step, the match block are filtered with the aid of an additional digital filter which enables a raster shift of the pixel raster by ¼ pel. Using this measure, a distortion of the motion vector field can be ruled out.

In the "MPEG-4 Video Verification Model Version 7.0", Bristol, April 1997, MPEG 97/N1642 in ISO/IEC JTC1/SC 29/WG11, an encoder and decoder for object-based coding of video image sequences are specified. In this context, one no longer encodes and transmits rectangular pictures of a fixed size to the receiver, but instead, so-called "VIDEO OBJECTS" (VO) of any shape and size. The image formation of such a VO in the camera image plane at a specific instant is referred to as a VIDEO OBJECTS PLANE (VOP). Consequently, the

relation between VO and VOP is equivalent to the relation between image sequence and image in the case of the transmission of rectangular pictures of fixed size.

The motion-compensating prediction in the verification model is carried out with the assistance of so-called "blockwise motion vectors" which, for each block of the size 8 x 8 or 16 x 16 pixels of the current image, specifies the position of the block used for the prediction in an already transmitted reference image. In this context, the resolution of the motion vectors is limited to half of a pixel, pixels between the scanning raster (half-pixel position) being generated by a bilinear interpolation filtering from the pixels on the scanning raster (integer pixel position) (Figure 1). In this case, + indicates the integer-pixel position, and O the half-pixel position. Interpolated values a, b, c, and d in half-pixel position are derived from the following relations:

a = A, b = (A + B)//2, c = (A + C)//2,

d = (A + B + C + D)//4, // indicating a rounded integer division.

Summary of the Invention

By applying the measures of the present invention, one can improve the quality of the prediction signal and, thus, the coding efficiency. In so doing, a greater local neighborhood is considered than in the case of bilinear interpolation, to generate pixels between the pixel scanning raster. The aliasing-reducing interpolation filtering according to the present invention leads to an increased resolution of the motion vector and, consequently, to a prediction gain and an increased coding efficiency. In the present invention, the

FIR filter coefficients can be adapted to the signals to be coded, and be transmitted separately for each video object, thereby further increasing coding efficiency and enhancing the flexibility of the method.

In contrast to the design approach according to European Patent EP 0 558 922 B1, there is no need design any additional polyphase filter structures for intermediate positions having ¼ pel pixel resolution in the horizontal and vertical directions.

By applying the measures of the present invention, the image sequence frequency of an MPEG-1 coder can be doubled from 25 Hz to 50 Hz, with the data rate remaining constant. In the case of an MPEG-2 coder, the data rate can be reduced by up to 30%, with the image quality remaining constant.

Brief Description of the Drawings

Exemplary embodiments of the present invention are explained in the following in greater detail, on the basis of the drawing, whose figures show:

Figure 2 an interpolation diagram for pixels between the pixel scanning raster;
Figure 3 the structure of an FIR filter for interpolation;
Figure 4 a further interpolation having an even higher resolution.

Description of Exemplary Embodiments

In the case of the method according to the present invention, motion vectors are formed for picture blocks, the

motion vectors, for each picture block of a current image, indicating the position of the picture block used for the prediction with respect to a chronologically preceding reference image.

The motion vectors for the prediction are determined in three successive steps:
In a first search step, a motion vector is determined for each picture block with pel accuracy in accordance with a conventional method, for example, in accordance with the full-search block matching method. In this context, the minimum error criterion is determined for possible motion positions, and the vector which best describes the motion of the picture block is selected (European Patent EP 0 368 151 B1).

In a second search step, which, again, is based on such a search for the minimum error criterion, an improved motion vector is ascertained with sub-pel accuracy, starting out from the motion vector ascertained in the first step, using an aliasing-reducing interpolation filtering, with the aid of a digital, symmetric FIR (finite impulse response) filter. In the process, a higher resolution is selected than in the first search step. Preferably, one selects a resolution of a half pixel relative to the pixel raster. Figure 2 illustrates the interpolation pattern for pixels b, c, and d between the pixel raster, as derived from the neighboring pixels A, B, C, D, E, F, G, H on the pixel raster. + indicates the integer-pixel position, O the half-pixel position, so that:

$$b = (CO1x(A_{-1} + A_{+1}) + CO2x\ (A_{-2} + A_{+2}) + CO3x\ (A_{-3} + A_{+3}) + CO4x\ (A_{-4} + A_{+4}))/256$$

$c_i = (CO1x(A_i + E_i) + CO2x(B_i + F_i) + CO3x\ (C_i + G_i) + GO4x(D_i + H_i))/256$

$d = (CO1x(c_{-1} + c_{+1}) + CO2x(c_{-2} + c_{+2}) + CO3x\ (c_{-3} + c_{+3}) + CO4x(c_{-4} + c_{+4}))/256$

The structure of the FIR interpolation filter used is apparent in Figure 3. Following each pixel position δp, it branches to a coefficient evaluator 1, 2, 3, etc., and has a summing device 10 at the output. As is apparent from the above relationships, a greater local neighborhood is considered when generating pixels between the scanning raster, than in the case of the bilinear interpolation according to the related art. In this context, the interpolation filter coefficients CO2, CO3, CO4 are determined in a way that minimizes the interpolation error performance. The coefficients can be determined directly using the known estimation method of the least root-mean-square error. From the minimization of the interpolation error performance, one obtains a linear system of equations, whose coefficients can be derived from the principle of orthogonality. A set of FIR filter coefficients optimized in this manner is given by the coefficients CO1 = 161/256, CO2 = -43/256, CO3 = 23/256, CO4 = -8/256.

In the third search step, starting from the motion vector determined with an accuracy of ½ pel, a local search is performed using a further interpolation filtering, taking the eight neighboring pixels as a basis, with resolution that is increased still further, preferably to ¼ pixel. As before, one selects the motion vector having the lowest prediction error performance.

Figure 4 shows the interpolation pattern for this. The

integer pixel positions are marked by X, the half-pixel positions by O, and the quarter-pixel positions by -. O indicates the best compensation with ½ pixel, and + the quarter-pixel search position.

The interpolation is carried out relative to the pixel raster, with a half-pixel resolution from the second search step, using filter coefficients CO1' = 1/2, CO2' = O, CO3' = O, CO4' = O.

The same previously introduced interpolation technique is used for the motion-compensating prediction.

If the processing is carried out within a coder having a reduced image format (SIF format within an MPEG1 coder or Q-CIF in an H.263 coder), but the original input format is used for the display, for example, CCIR 601[1] in the case of MPEG-1 or CIF in the case of H.263, a local interpolation filtering must be carried out as a post-processing. The described aliasing-compensating interpolation filtering can be used for this purpose as well.

To activate the aliasing-compensating interpolation using 1/4 resolution, activation bits can be inserted into an image-transmission bit stream.

To predict video objects, filter coefficients CO1 through CO4, and CO1' through CO4' can be separately conditioned for each of the video objects VO, and inserted into the image-transmission bit stream at the beginning of transmission of the video object in question.

For the encoding of a motion vector, the range of values of

the motion vector differences to be coded can be adapted to the increased resolution.

Patent Claims

1. A method for generating an improved image signal when estimating the motion of image sequences, in particular a prediction signal for video images using motion-compensating prediction, with motion vectors, which, for each picture block of a current image, indicate the position of the picture block used for the prediction with respect to a chronologically preceding reference image, being formed for picture blocks, comprising the following steps:
- in a first search step, a motion vector is determined with pel accuracy;
- starting out from the motion vector, in a second search step, an improved motion vector is ascertained with sub-pel accuracy by aliasing-reducing interpolation filtering, using a digital filter, the resolution being selected to be higher than that corresponding to the resolution of the pixel raster in the first search step, and more neighboring pixels being utilized for the interpolation than in the case of a bilinear interpolation;
- in a third search step, starting from the motion vector determined with sub-pel accuracy, a further improved motion vector is determined by a further interpolation filtering using the digital filter, the resolution being increased once more in comparison with the second search step, and the interpolation being carried out on the basis of the pixel raster, with the resolution in the second search step.

2. The method as recited in Claim 1,
characterized in that, for the interpolation filtering in the second search step, an FIR filter is used having the filter coefficients CO1 = 161/256, CO2 = -43/256, CO3 = 23/256, CO4 = -8/256.

3. The method as recited in Claim 1 or 2, characterized in that, for the interpolation filtering in the third search step, an FIR filter is used having the FIR filter coefficients CO1' = 1/2, CO2' = O, CO3' = O, CO4' = O.

4. The method as recited in one of the Claims 1 through 3, characterized in that, to predict video objects (VO), the filter coefficients of the digital filter/FIR filter are separately conditioned for each video object, and inserted into a transmission bit stream at the beginning of transmission of the object in question.

5. The method as recited in one of the Claims 1 through 4, characterized in that, for the encoding of a motion vector, in particular for a transmission, the range of values of the motion vector differences to be coded is adapted to an increased resolution.

Abstract

To generate an improved image signal when estimating motion, a motion vector is first determined with pel accuracy, and a two-step interpolation filtering is subsequently carried out with sub-pel accuracy. The interpolation coefficients are selected with a view to reducing aliasing. More neighboring pixels are used for the interpolation than in usual interpolation methods.

One is able to improve the quality of the prediction signal for video images and, consequently, enhance coding efficiency.

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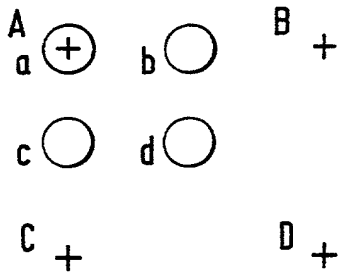

Fig.1

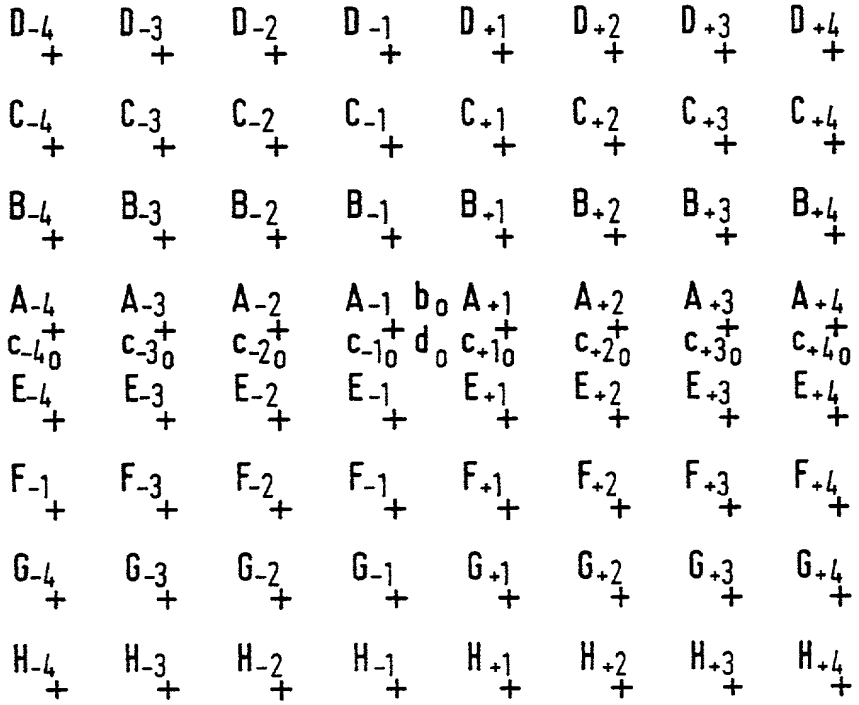

Fig.2

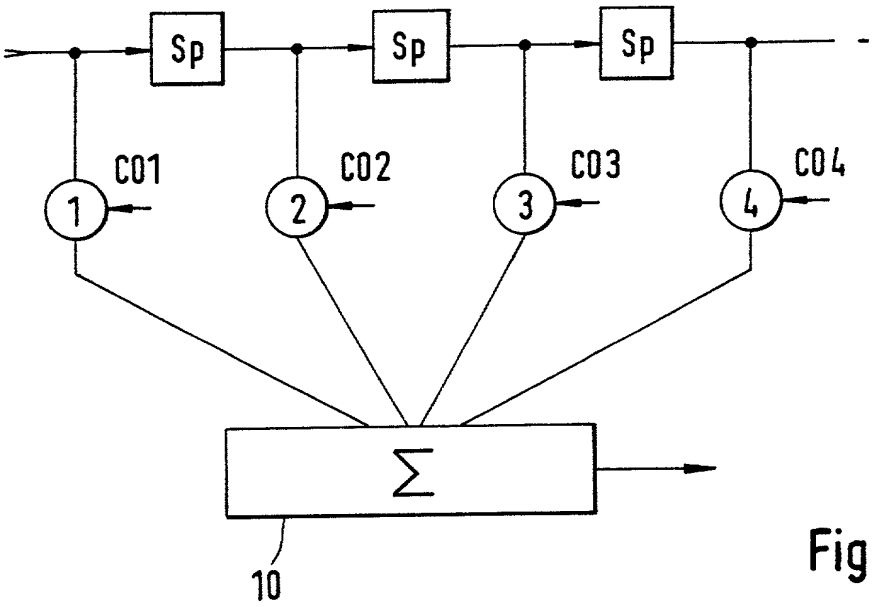

Fig.3

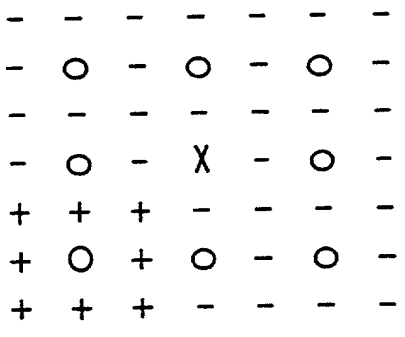

Fig.4

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COMBINED DECLARATION AND
POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below adjacent to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "**METHOD FOR GENERATING AN IMPROVED IMAGE SIGNAL WHEN ESTIMATING THE MOTION OF IMAGE SEQUENCES, IN PARTICULAR A PREDICTION SIGNAL FOR VIDEO IMAGES USING MOTION-COMPENSATING PREDICTION",** and the specification of which:

[ ] is attached hereto;

[ ] was filed as United States Application Serial No. _____ on _____, 19__ and was amended by the Preliminary Amendment filed on _____, 19__.

[X] was filed as PCT International Application Number PCT/DE98/01938, on the 11th day of July, 1998.

[X] an English translation of which is filed herewith.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international applications(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on

EL179950210US

the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S)
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119

Country : Germany

Application No. : 1 97 30 305.6

Date of Filing: July 15, 1997

Priority Claimed
Under 35 U.S.C. § 119 : [X] Yes [ ] No

I hereby claim the benefit under Title 35, United States Code § 120 of any United States Application or PCT International Application designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR
PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120

U.S. APPLICATIONS

Number :

Filing Date :

PCT APPLICATIONS
DESIGNATING THE U.S.

PCT Number :

PCT Filing Date :

I hereby appoint the following attorney(s) and/or agents to prosecute the above-identified application and transact all business in the Patent and Trademark Office connected therewith.

(List name(s) and registration number(s)):

(2)

Richard L. Mayer, Reg. No. 22,490
Gerard A. Messina, Reg. No. 35,952
_____, Reg. No. _____
_____, Reg. No. _____

All correspondence should be sent to:

Richard L. Mayer, Esq.
Kenyon & Kenyon
One Broadway
New York, New York 10004

Telephone No.: (212) 425-7200
Facsimile No.: (212) 425-5288

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1-00.

Full name of inventor Ulrich BENZLER

Inventor's signature Ulrich Benzler Date Feb. 11 2000

Citizenship Federal Republic of Germany

Residence Am Krähenberg 18
30855 Langenhagen
Federal Republic of Germany DEX

Post Office Address Same as above

2.00

Full name of inventor Oliver WERNER

Inventor's signature [signature] Date 12 Feb. 2000

Citizenship Federal Republic of Germany

Residence ~~Flat/Birdhurst Road, South Croydon~~
~~Surrey CR2 7EA~~
~~Great Britain~~

Tordenskioldstr. 16A
30880 Laatzen
Germany DEX

Post Office Address Same as above